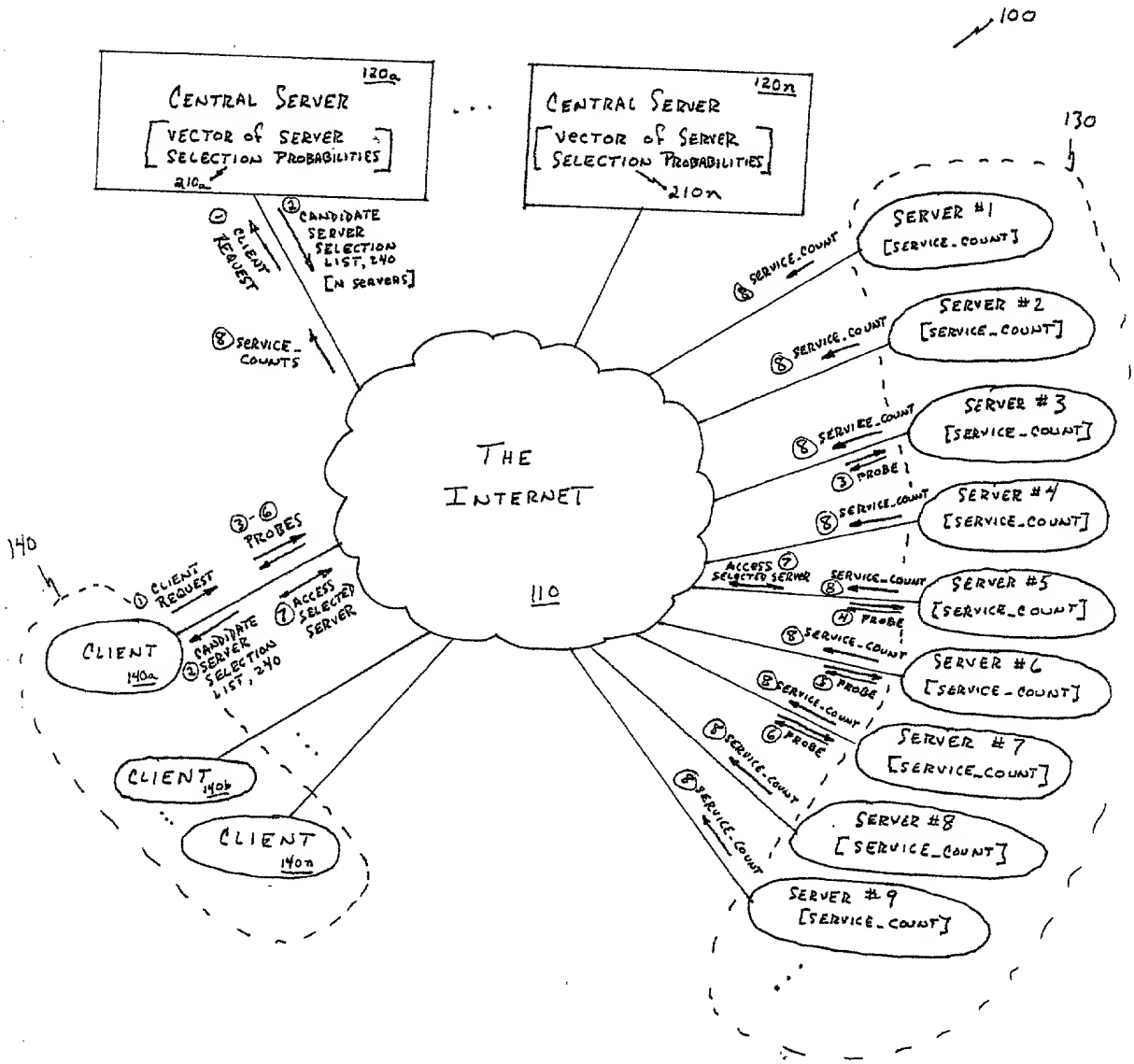

100
CENTRAL SERVER 120a
[VECTOR of SERVER SELECTION PROBABILITIES]
210a
CENTRAL SERVER 120n
[VECTOR of SERVER SELECTION PROBABILITIES]
210n
130
SERVER #1 [SERVICE_COUNT]
SERVER #2 [SERVICE_COUNT]
SERVER #3 [SERVICE_COUNT]
SERVER #4 [SERVICE_COUNT]
SERVER #5 [SERVICE_COUNT]
SERVER #6 [SERVICE_COUNT]
SERVER #7 [SERVICE_COUNT]
SERVER #8 [SERVICE_COUNT]
SERVER #9 [SERVICE_COUNT]
THE INTERNET
110
140
CLIENT 140a
CLIENT 140b
CLIENT 140n
① CLIENT REQUEST
② CANDIDATE SERVER SELECTION LIST, 240 [N SERVERS]
③-⑥ PROBES
⑦ ACCESS SELECTED SERVER
⑧ SERVICE_COUNTS

FIG. 1

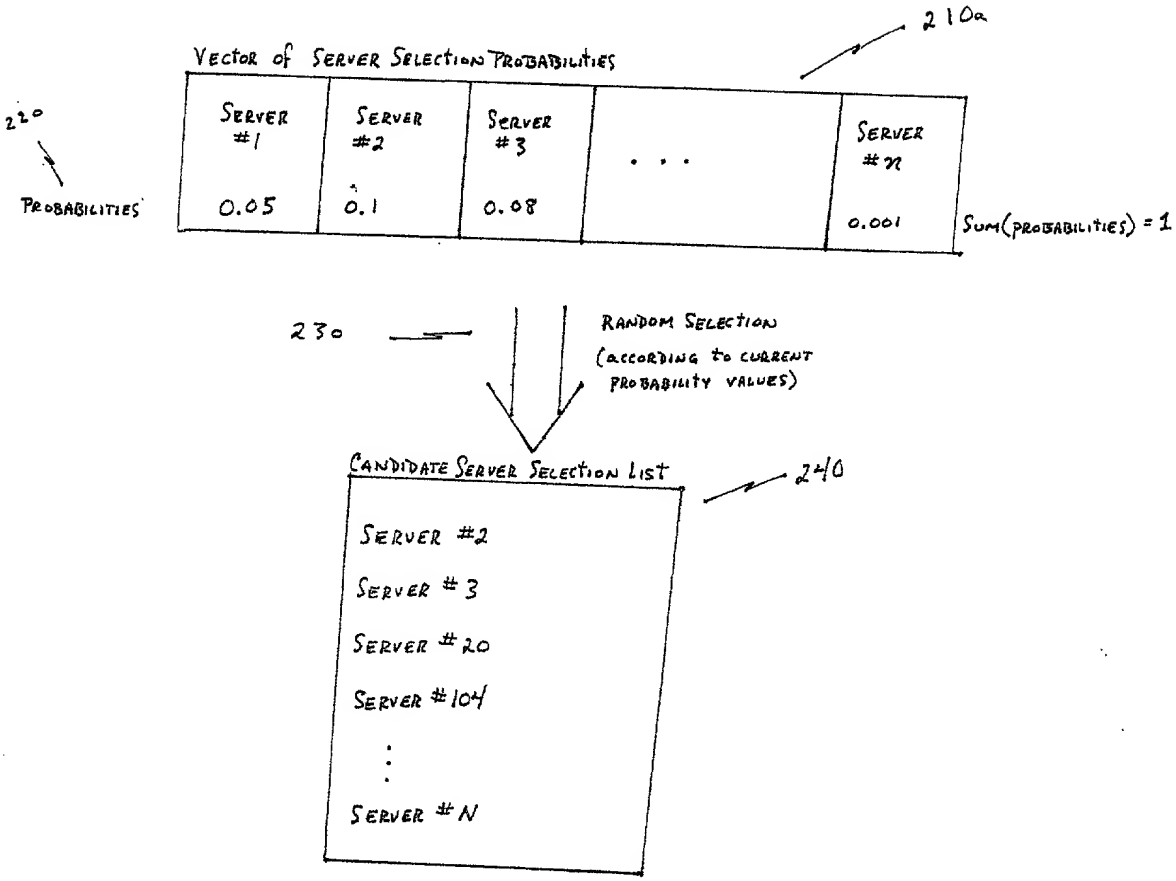

210a
Vector of Server Selection Probabilities
220
Probabilities
Server #1
Server #2
Server #3
Server #n
0.05
0.1
0.08
0.001
Sum(probabilities) = 1
230
Random Selection
(according to current probability values)
Candidate Server Selection List
240
Server #2
Server #3
Server #20
Server #104
Server #N

FIG. 2

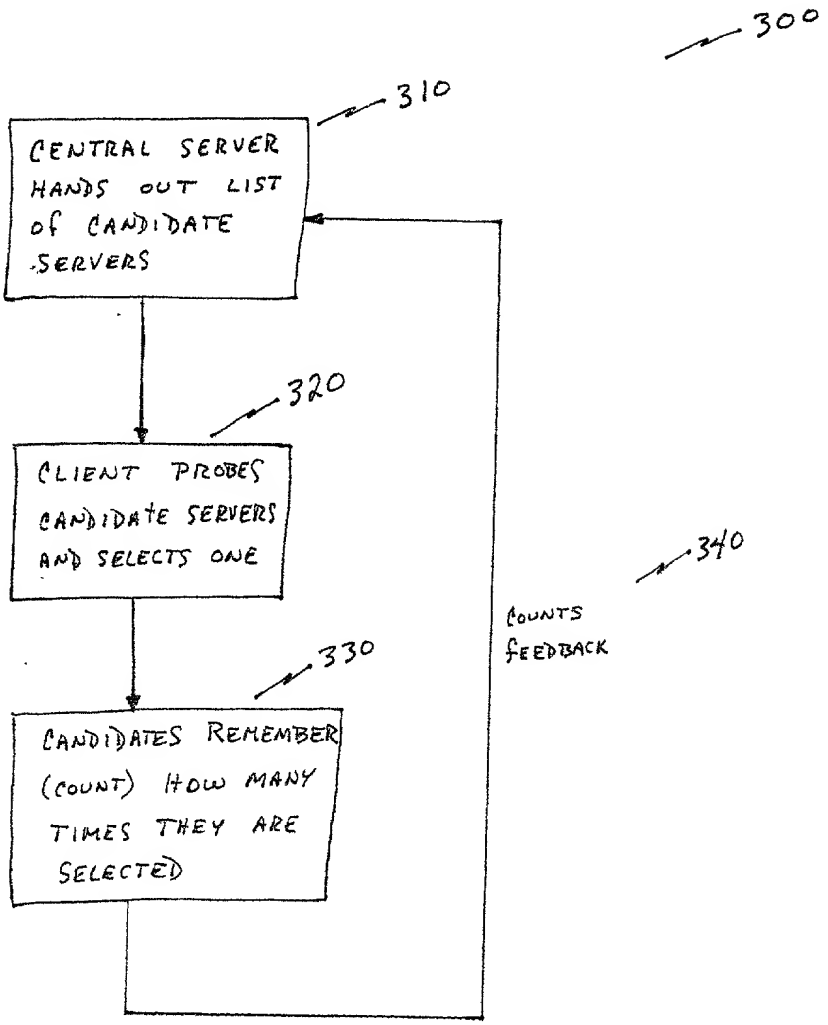

300
310
CENTRAL SERVER HANDS OUT LIST OF CANDIDATE SERVERS
320
CLIENT PROBES CANDIDATE SERVERS AND SELECTS ONE
330
CANDIDATES REMEMBER (COUNT) HOW MANY TIMES THEY ARE SELECTED
340
COUNTS FEEDBACK

FIG. 3

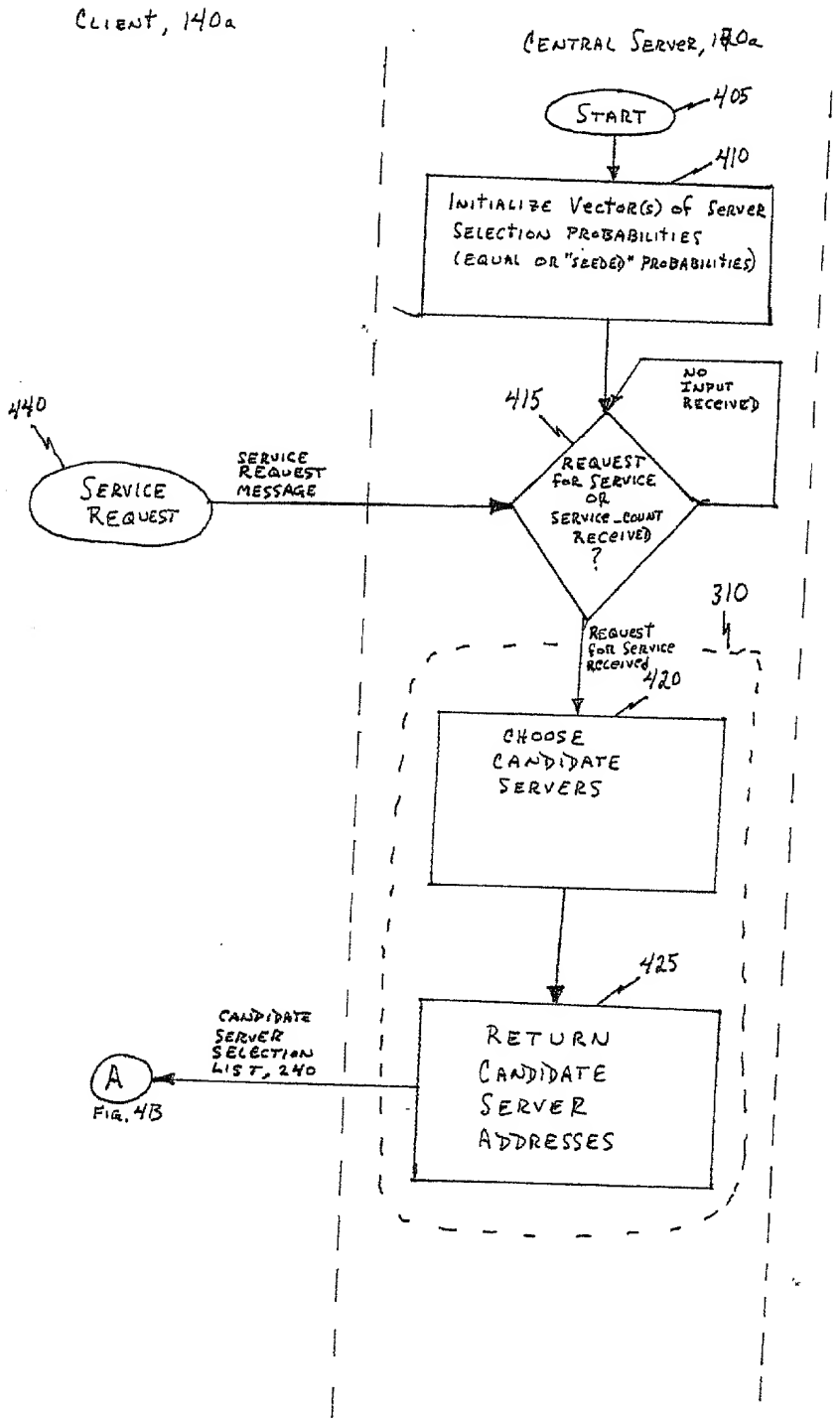

CLIENT, 140a
CENTRAL SERVER, 170a
CANDIDATE SERVER, 130a
START
405
410
INITIALIZE VECTOR(S) OF SERVER SELECTION PROBABILITIES (EQUAL OR "SEEDED" PROBABILITIES)
NO INPUT RECEIVED
415
440
SERVICE REQUEST
SERVICE REQUEST MESSAGE
REQUEST FOR SERVICE OR SERVICE_COUNT RECEIVED ?
310
REQUEST FOR SERVICE RECEIVED
420
CHOOSE CANDIDATE SERVERS
425
CANDIDATE SERVER SELECTION LIST, 240
A
RETURN CANDIDATE SERVER ADDRESSES

FIG. 4B

FIG. 4A

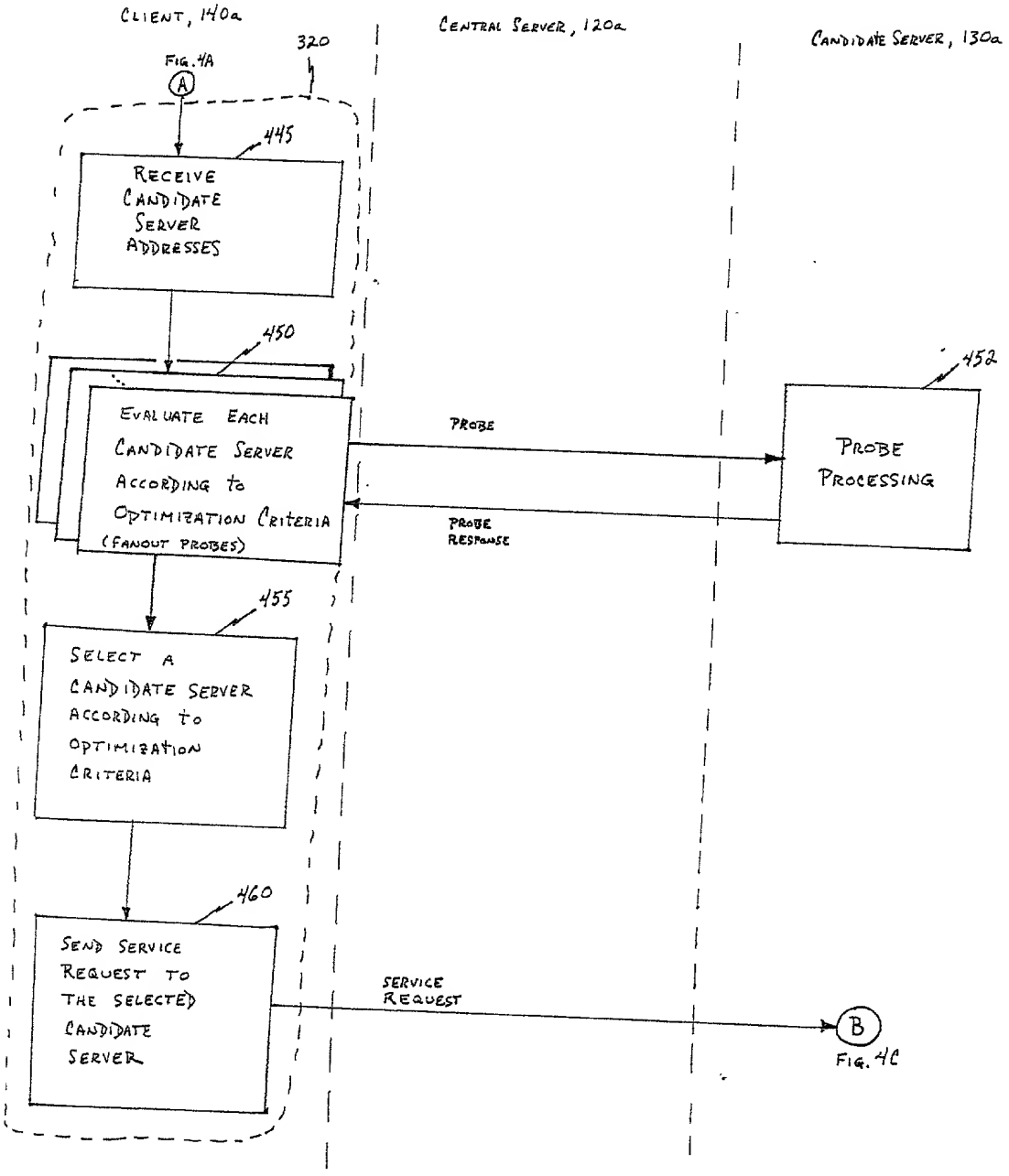

CLIENT, 140a
320
CENTRAL SERVER, 120a
CANDIDATE SERVER, 130a
FIG. 4A
A
445
RECEIVE CANDIDATE SERVER ADDRESSES
450
EVALUATE EACH CANDIDATE SERVER ACCORDING TO OPTIMIZATION CRITERIA (FANOUT PROBES)
452
PROBE
PROBE PROCESSING
PROBE RESPONSE
455
SELECT A CANDIDATE SERVER ACCORDING TO OPTIMIZATION CRITERIA
460
SEND SERVICE REQUEST TO THE SELECTED CANDIDATE SERVER
SERVICE REQUEST
B
FIG. 4C

FIG. 4B

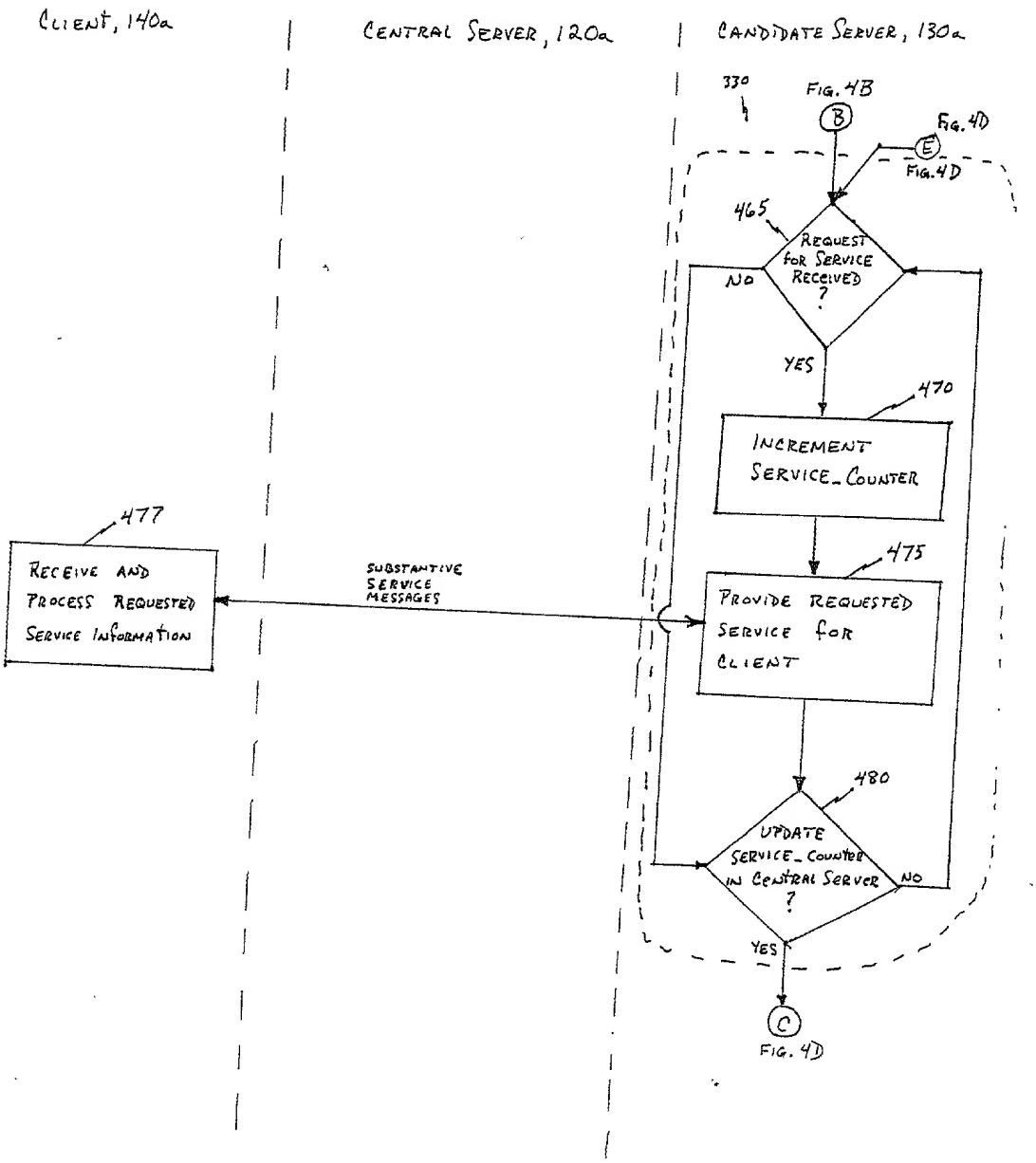

CLIENT, 140a
CENTRAL SERVER, 120a
CANDIDATE SERVER, 130a
330
FIG. 4B
B
FIG. 4D
E
FIG. 4D
465
REQUEST FOR SERVICE RECEIVED ?
NO
YES
470
INCREMENT SERVICE_COUNTER
475
PROVIDE REQUESTED SERVICE FOR CLIENT
480
UPDATE SERVICE_COUNTER IN CENTRAL SERVER ?
NO
YES
C
FIG. 4D
477
RECEIVE AND PROCESS REQUESTED SERVICE INFORMATION
SUBSTANTIVE SERVICE MESSAGES

FIG. 4C

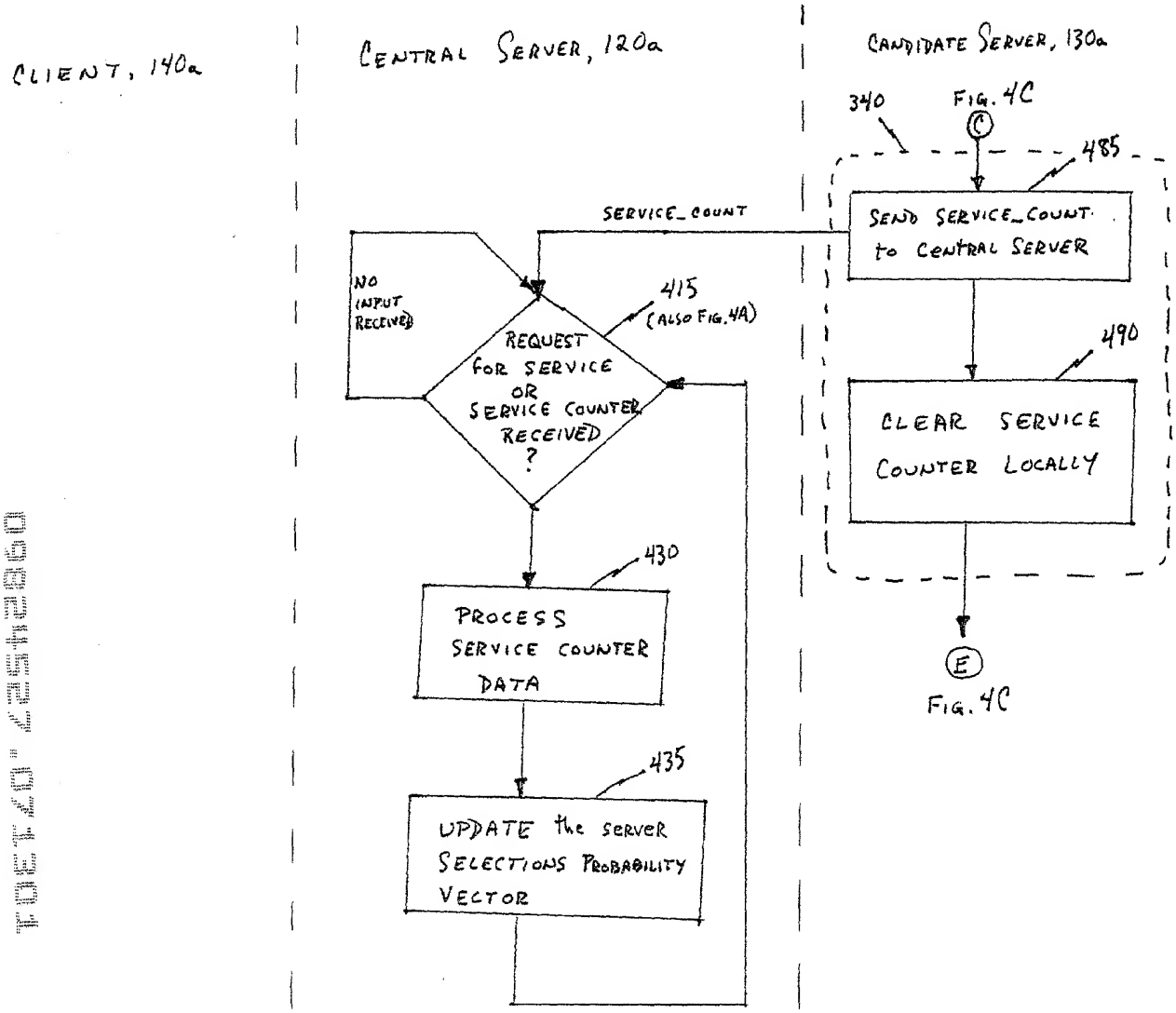

CLIENT, 140a
CENTRAL SERVER, 120a
CANDIDATE SERVER, 130a
340
FIG. 4C
C
485
SEND SERVICE_COUNT to CENTRAL SERVER
SERVICE_COUNT
NO INPUT RECEIVED
415
(ALSO FIG. 4A)
REQUEST FOR SERVICE OR SERVICE COUNTER RECEIVED ?
490
CLEAR SERVICE COUNTER LOCALLY
430
PROCESS SERVICE COUNTER DATA
435
UPDATE the server SELECTIONS PROBABILITY VECTOR
E
FIG. 4C

FIG. 4D

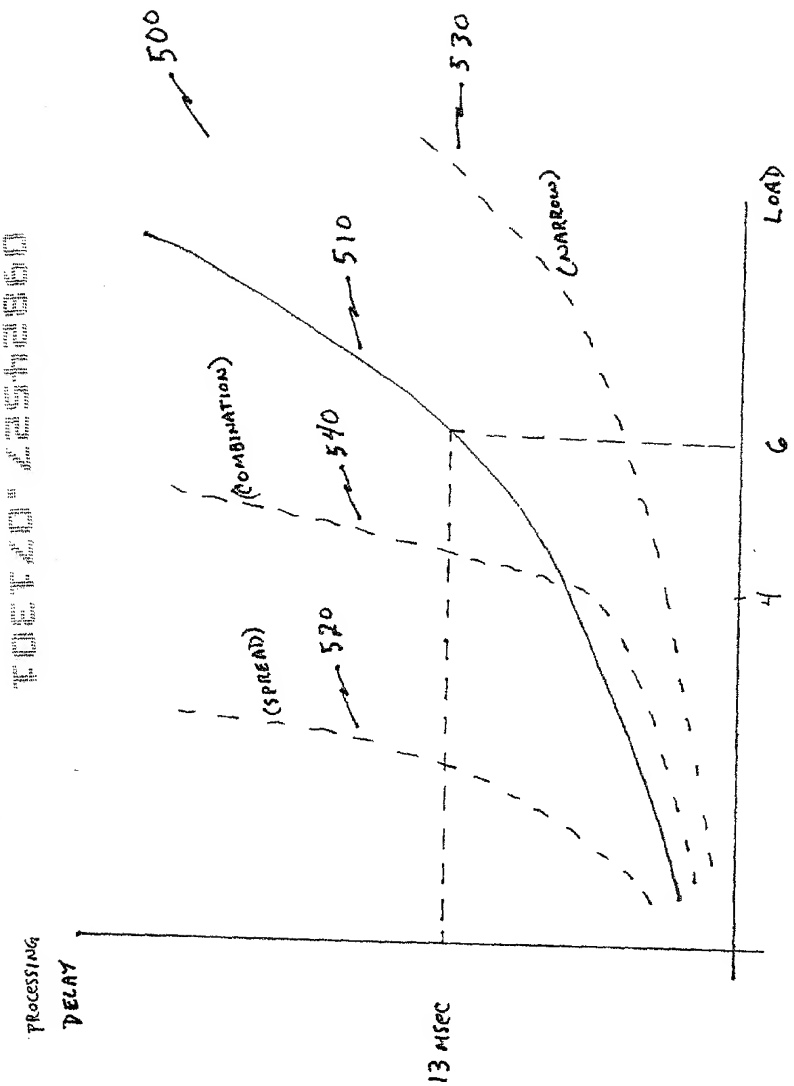

500
530
510
(NARROW)
LOAD
(COMBINATION)
540
(SPREAD)
520
6
4
PROCESSING
DELAY
13 MSEC

Fig. 5

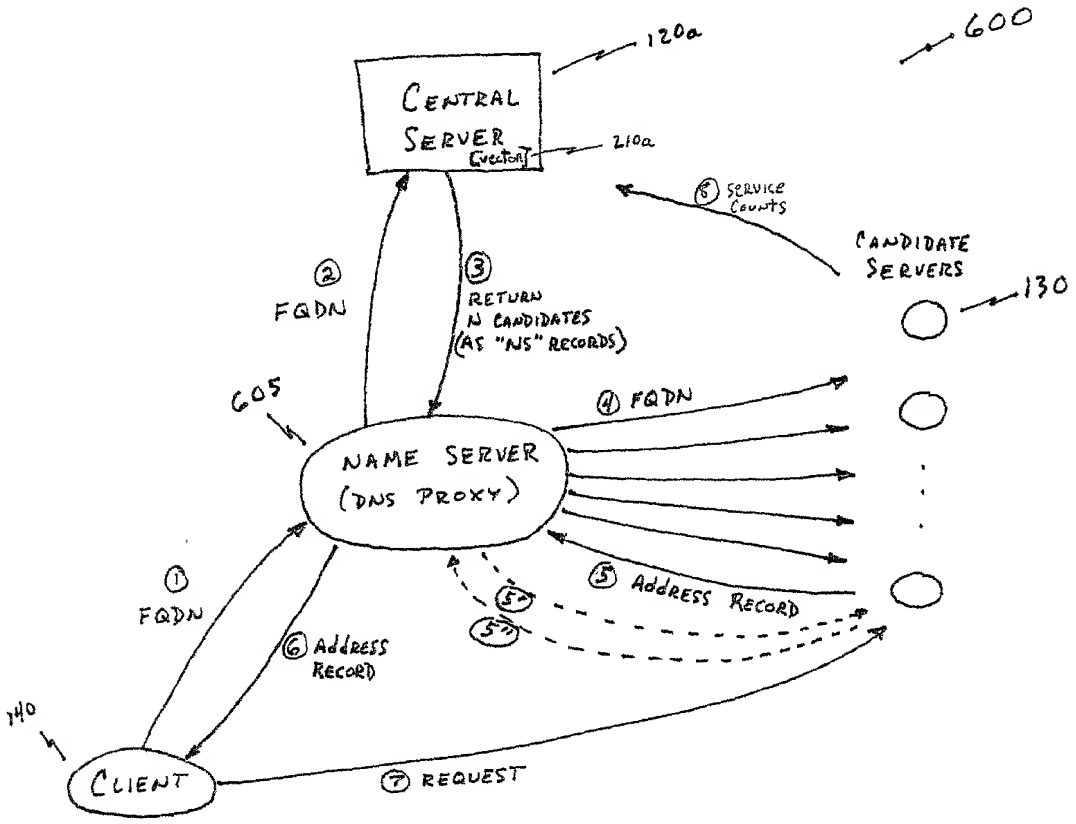

600
120a
CENTRAL SERVER
Director
210a
8 SERVICE COUNTS
CANDIDATE SERVERS
130
2 FQDN
3 RETURN N CANDIDATES (AS "NS" RECORDS)
605
4 FQDN
NAME SERVER (DNS PROXY)
1 FQDN
5 Address Record
5'
5''
6 Address Record
140
CLIENT
7 REQUEST

FIG. 6

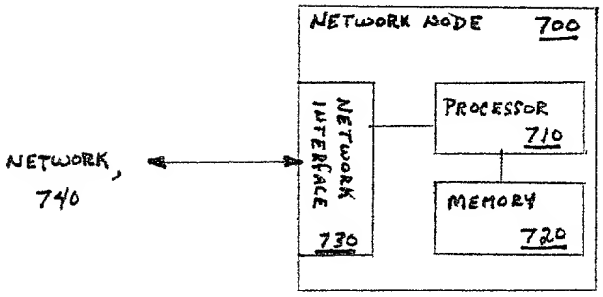

NETWORK NODE 700
NETWORK INTERFACE 730
PROCESSOR 710
MEMORY 720
NETWORK 740

FIG. 7

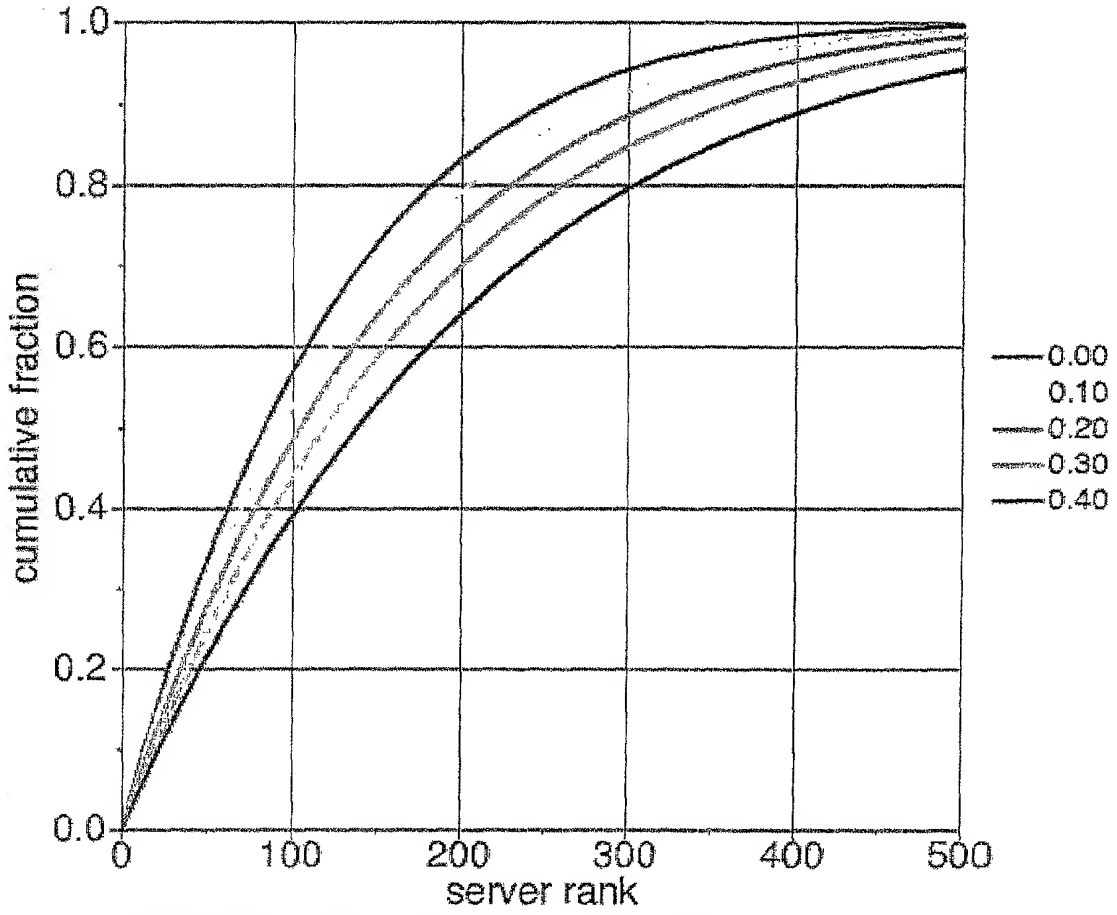

1.0
0.8
0.6
0.4
0.2
0.0
cumulative fraction
0
100
200
300
400
500
server rank
0.00
0.10
0.20
0.30
0.40
minimalist routing performance on 1,000 servers, round 1
(packet loss rates between 0.00 and 0.40)

FIG. 8

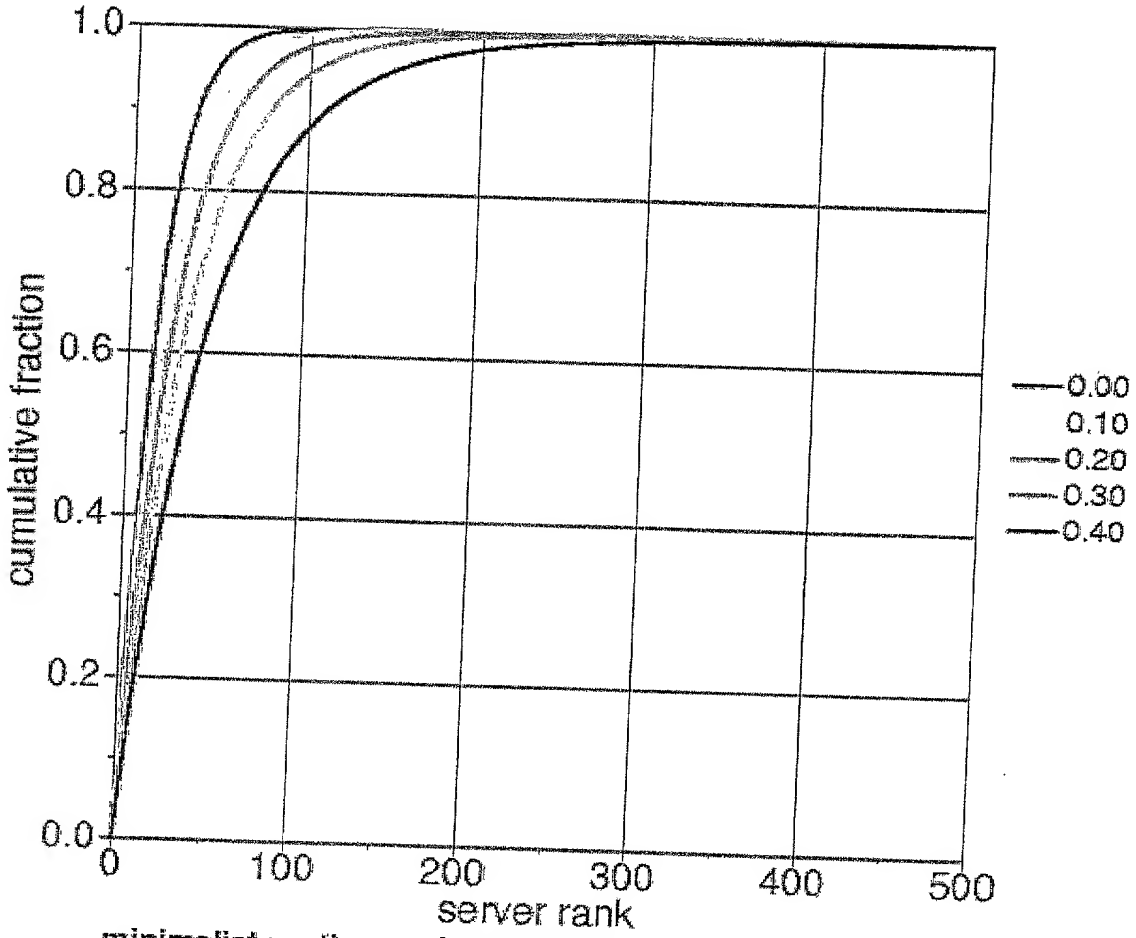
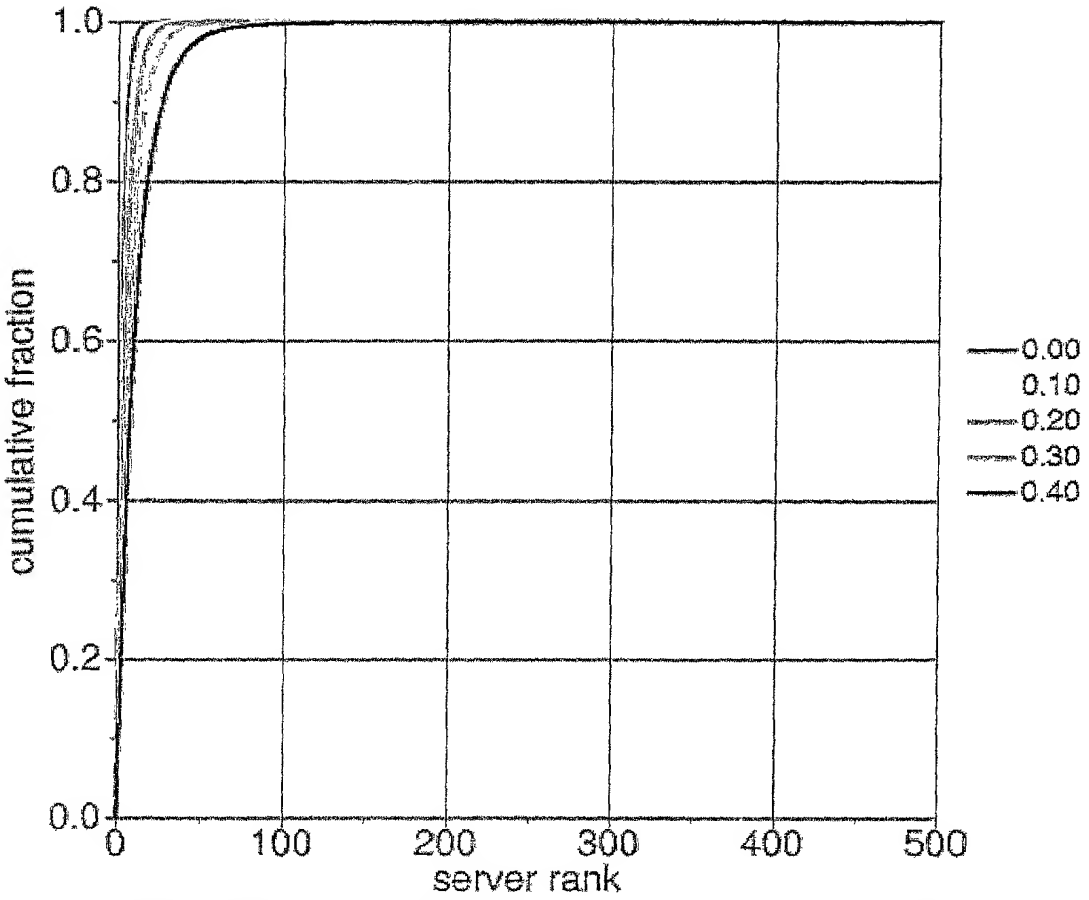

1.0
0.8
0.6
0.4
0.2
0.0
cumulative fraction
0
100
200
300
400
500
server rank
0.00
0.10
0.20
0.30
0.40
minimalist routing performance on 1,000 servers, round 2
(packet loss rates between 0.00 and 0.40)

Fig. 9



minimalist routing performance on 1,000 servers, round 3
(packet loss rates between 0.00 and 0.40)

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Fig. 10

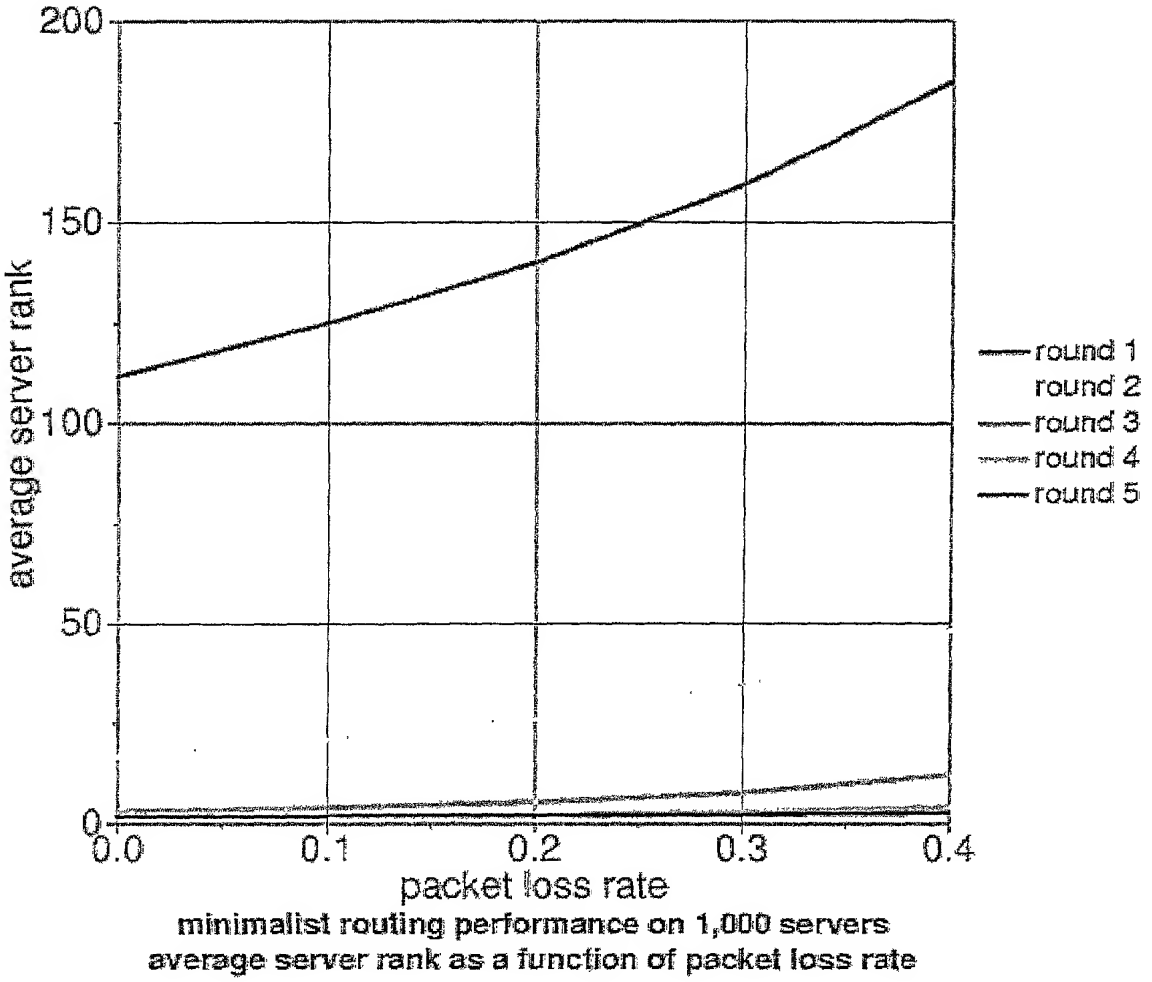
200
150
100
50
0
average server rank
0.0
0.1
0.2
0.3
0.4
packet loss rate
round 1
round 2
round 3
round 4
round 5
minimalist routing performance on 1,000 servers
average server rank as a function of packet loss rate

FIG. 11